List of figures

Figure No.	Figure Caption	Page No.
Figure 1.1	Schematic representation showing typical components of a sensor.	1
Figure 1.2	Schematic representation of a sensor showing electrical	2
	output in response to the presence of an input quantity.	
Figure 1.3	Classification of chemical sensors on the basis of sensing	3
	objects.	
Figure 1.4	Piezoelectric effect: a pressure exerted on a quartz crystal	4
	results in an electric field.	
Figure 1.5	Schematic representation of electrochemical cell showing	5
	different components.	
Figure 1.6	Schematic representation showing first generation glucose	11
	sensors.	
Figure 1.7	Schematic representation of glucose sensor from second	12
	generation	
Figure 1.8	Schematic representation of third generation glucose sensors.	13
Figure 1.9	Different types of nanoparticles used for different applications	14
Figure 1.10	Schematic representation showing protein immobilisation	16
	onto Fe NPs utilising (strept) avidin-biotin technology.	
Figure 1.11	Reduction of 4-nitrophenol to 4-aminophenol catalyzed by Ag	17
	NPs supported on polymer micelles and vesicles matrix.	
Figure 1.12	Schematic representation showing binding of gold	18
	nanoclusters incorporating anthraquinone redox molecule	
	with dithiol self assembled monolayer.	
Figure 1.13	Schematic representation of the electrochemical detection of	19
	DNA hybridization based on platinum NPs combined with	
	MWNTs.	
Figure 1.14	Schematic showing the electro-deposition of Uracil on CPE	26
Figure 1.15	(a) Schematic representation showing photochemically	27
	assisted synthesis of silver NPs stabilized by DTZH.	
	(b) Schematic showing various phenomenon occurring during	
	photochemically assisted synthesis of Ag NPs like nucleation	
	and growth phenomenon.	

Figure 1.16	Schematic representation showing detection of nitrite using	28
	Fe ₂ O ₃ / rGO composite	
Figure 1.17	Model showing electro-catalytic reaction on CME.	35
Figure 2.1	Schematic representations for various interactions between	44
	components used for Ch@Ag NPs formation and AZT	
	sensing.	
Figure 2.2	UV-visible spectra of (a) Ch and (b) Ch@Ag NPs in water.	45
	Inset shows zoomed view of Ch from 200 nm to 300 nm.	
Figure 2.3	Surface zeta potential graphs of Ch@Ag NPs.	46
Figure 2.4	FT-IR spectrum of (a) Ch and (b) Ch@Ag NPs.	47
Figure 2.5	EDAX spectrum and EDAX mapping of Ch@Ag NPs.	48
Figure 2.6	SEM of (a) Ch and (b) Ch@Ag NPs.	49
Figure 2.7	(a) TEM image, (b) SAED pattern and (c) particle size	50
	distribution of Ch@Ag NPs.	
Figure 2.8	CV of (a) Commercial GCE and (b) Ch@Ag NPs/GCE in 0.1	52
	M PBS (pH 7.6).	
Figure 2.9	CV of (a) bare commercial Ag electrode, (b) bare commercial	52
	GCE and (c) Ch@Ag NPs/GCE in presence of AZT in 0.1 M	
	PBS (pH =7.6).	
Figure 2.10	CV of 295 μM and 439 μM AZT over commercial Ag	53
	electrode (a & b) and Ch@Ag NPs/GCE (c & d) at scan rate	
	50 mV/s.	
Figure 2.11	CV of 100µM AZT over Ch@Ag NPs/GCE at a scan rate 50	54
	mV/s.	
Figure 2.12	CV of (a) commercial GCE, (b) commercial Ag electrode, (c)	55
	Ch@Ag NPs/GCE at different scan rates from (i) 10, (ii) 20,	
	(iii) 50, (iv) 100, (v) 200, (vi) 300, (vii) 400 and (viii) 500	
	mV/s in 0.1 M PBS (pH 7.6) and (d) plot of reduction current	
	vs. square root of scan rate of (I) commercial Ag, (II)	
	commercial GC electrode and (III) Ch@Ag NPs/GCE.	
Figure 2.13	(I) CV response of Ch@Ag NPs/GCE in PBS at pH=7.6 after	57
	serial addition of AZT from 74 μ M to 718 μ M concentration	
	and (II) corresponding calibration plot showing AZT	

concentration *vs*. Change in reduction current with good correlation coefficient of 0.985.

Figure 2.14 (I) DPV response of Ch@Ag NPs/GCE in PBS at pH = 7.658 after serial addition of AZT from 1 µM to 410 µM concentration and (II) corresponding calibration plot showing AZT concentration vs. change in reduction current with good correlation coefficient of 0.997. 59 Figure 2.15 (I) CV response on Ch@Ag NPs/SPGE after serial addition of AZT from 10 µM to 600 µM concentration range in PBS at pH = 7.6 with their corresponding calibration plot (II) with good correlation coefficient of 0.986 and (III) CV response on Ch@Ag NPs/SPGCE after serial addition of AZT from 10 μ M to 533 μ M concentration range in human plasma at pH = 7.6 with their corresponding calibration plot (IV) with good correlation coefficient of 0.986. Figure 2.16 Proposed mechanism of AZT electro-catalysis over Ch@Ag 60 NPs. Figure 3.1 Structure of Nevirapine. 63 Figure 3.2 Schematic representation of Pd@rGO synthesis. 68 Figure 3.3 Schematic representation of MoS₂ QDs synthesis. 69 Figure 3.4 Schematic representation of 2-D composite (Pd@rGO/ MoS₂ 69 QDs) formation Figure 3.5 UV-Vis. Absorption spectra of 2-D materials. 71 FT-IR spectra of a) GO b) Pd@rGO, c) MoS₂ QDs d) 72 Figure 3.6 Pd@rGO/ MoS₂ QDs. 74 Figure 3.7 Structural investigation by TEM a) Pd@rGO (inset showing SAED pattern) b) Pd@rGO size distribution profile, c) MoS₂ QDs (inset showing its SAED pattern and interlayer spacing), d) MoS_2 QDs size distribution profile, e) Pd@rGO/ MoS_2 QDs (inset showing SAED pattern), f) its size distribution profile. Figure 3.8 EDAX spectra of 2-D materials a) Pd@rGO b) MoS₂ c) 75

Pd@rGO/ MoS₂ QDs.

Figure 3.9	EDAX mapping of Pd@rGO/ MoS2 QDs.	76
Figure 3.10	Zeta Potential measurements of 2D materials.	77
Figure 3.11	CV response of bare GCE at different pH in PBS in presence	78
	of 200 µM NVP.	
Figure 3.12	CV response of different electrode GCE in PBS (pH 10) a)	80
	GCE b) bare GCE in 1 mM K4[Fe (CN) 6] c) of Pd@rGO/	
	MoS ₂ QDs modified GCE in 1 mM K ₄ [Fe (CN) ₆].	
Figure 3.13	CV response of different electrodes in phosphate buffer	80
	solution (pH 10) a) bare GCE, b) Bare GCE in 27 μ M NVP,	
	c) modified MoS_2 QDs GCE in 27 μM NVP, d) modified	
	Pd@rGO GCE in 27 μ M NVP, e) Pd@rGO/ MoS ₂ QDs GCE	
	in 27 μM NVP.	
Figure 3.14	CV response of 2-D materials modified GCE towards electro-	83
	oxidation of NVP from 1 μ M to 80 μ M concentration in PBS	
	(pH 10, 0.1M) I) Pd@rGO III) MoS2 QDs V)Pd@rGO/MoS2	
	QDs composite and II, IV, VI its corresponding calibration	
	plots.	
Figure 3.15	Electrochemical response of 2-D composite modified	84
	electrodes for DPV a) Pd@rGO c) MoS2 QDs e) Pd@rGO/	
	MoS ₂ QDs in presence of NVP at different concentrations	
	from 0.1 μ M to 80 μ M and their corresponding calibration	
	plot b), d), f) respectively.	
Figure 3.16	Electrode fabrication process and plausible mechanism for	85
	electro-oxidation of NVP on 2D composite modified	
	electrode surface.	
Figure 3.17	Plausible mechanisms for oxidation of NVP at pH 10.	86
Figure 3.18	DPV response of modified Pd@rGO/ MoS2 QDs composite	87
	GCE surface on successive addition of NVP from 5 μM to 80	
	μM concentration in human serum.	
Figure 3.19	CV response of modified Pd@rGO/ MoS_2 QDs composite	87
	GCE surface on successive addition of NVP from 5 μM to 80	
	μM concentration in human serum.	
Figure 3.20	Peak current response of NVP in presence of Urea, Uric Acid,	89

iv

Ascorbic Acid and Glucose.

- Figure 4.1
 CV response of NVP (from 1 μM conc. to 80 μM) on MoS2
 95

 decorated Pd@rGO SPGE and its corresponding calibration plot.
 95
- Figure 4.2 DPV response of NVP (from 1 μM conc. to 80 μM) on MoS₂ 96 decorated Pd@rGO SPGE and its corresponding calibration plot.
- Figure 4.3 Effect of scan rate on NVP oxidation over Pd@rGO / MoS₂
 97 QDs modified SPGE and calibration plot between sq. Root of scan rate and current.
- Figure 4.4 CV response of successive AZT addition over MoS₂ QDs 97 decorated Pd@rGO modified SPGE and its corresponding calibration plot.
- Figure 4.5Effect of scan rate on AZT sensing and plot between Square98Root of scan rate and current.
- Figure 4.6Effect on modification on NVP oxidation and AZT reduction.99
- Figure 4.7 Schematic representations of NVP oxidation and AZT 100 reduction using a single MoS₂ QDs decorated Pd@rGO SPGE.
- Figure 4.8 Pd@rGO/ MoS₂ QDs modified SPGE towards 101 electrochemical detection of AZT and NVP and their corresponding calibration plots.
- Figure 4.9 Effect of scan rates on NVP oxidation and AZT 102 reduction.
- Figure 5.1Schematic showing synthesis of Pd@TTF using two simple107accessible components in a single step.
- Figure 5.2 (A) UV-vis. absorption spectra of (a) TTF (b) Pd@TTF. (B) 109 FT-IR spectra of (a) TTF and (b) Pd@TTF.
- Figure 5.3TEM image of Pd@TTF (a), SAED pattern (b) and EDAX111pattern (c), deconvoluted peak for Pd (d) and sulphur (e).
- Figure 5.4EDAX mapping of Pd@TTF a) STEM image Pd@TTF,112Mapping of individual elements c) Carbon d) Sulphur e)Palladium.

Figure 5.5	CVs of the electrodes (GC, GC/TTF and GC/Pd@TTF) in the	113
	absence (A) and presence of 5.0 mM of Fe (II)/Fe (III) redox	
	couple (B) in 0.1 M phosphate buffer solution (pH 7.4).	

Figure 5.6 Cyclic voltammograms of bare GC (A), GC/TTF (B) and 115 GC/Pd@TTF in absence (a) and presence of 1.0 mM of CFZ in 0.1 M PBS (pH 7.4) at scan rate 50 mVs⁻¹. (D) CV response of Pd@TTF after successive addition of CFZ (1.0, 15.0, 30.0, 55.0 and 78 μM). Insert shows the corresponding calibration plot.